14 An observation on the occurrence of pine mycorrhiza-like structures in association with bracken rhizomes

S. Kondas

The bracken *Pteridium aquilinum* (L.) Kuhn is an invasive rhizomatous fern of the open, moist plateau grasslands of the Western Ghats in South India. In young plantations of *Pinus patula* Schiede & Deppe raised in grasslands, pine laterals are sometimes noticed tunnelling through fragments of decayed bracken rhizome. In one particular instance many branches arose from a portion of a lateral covered by rhizome to a length of 15 cm. This, together with the occurrence of coralloid mycorrhiza-like structures, contrasted sharply with the very few branches and extremely few mycorrhiza-like forked roots on the uncovered region of the same root (Fig. 14.1).

Of the many soluble and insoluble carbon sources of ectomycorrhizal fungal metabolites studied by Palmer and Hacskaylo (1970),

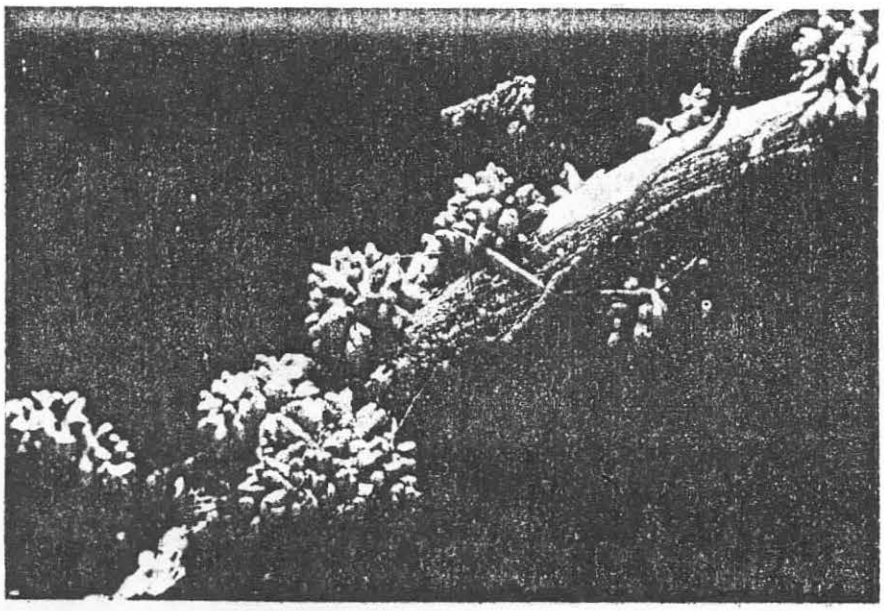

Fig. 14.1. Coralloid mycorrhiza-like structures on a pine root within the bracken rhizome casing.

the most important ones were found to be D-glucose and D-mannose. Bracken rhizome contains both, the former comprising 60 per cent of the nucleotide sugars and the latter 5 per cent, besides a number of other sugars and sugar derivatives which may very well form energy and nutrient sources for the mycorrhizal fungi.

Ectomycorrhizal fungi provide their hosts with hormones (auxins, cytokinins, gibberellins) and growth regulating B-vitamins. The excess hormonal substances promote root morphogenesis. Slankis (1958), using indoleacetic acid of different concentrations, showed varying degrees of morphogenesis on attached roots of *Pinus strobus*. At lower concentrations dichotomy of roots occurred, while at five to ten times higher concentration structures closely resembling simple and coralloid mycorrhizae were formed. Turner (1962) in his study of 53 fungal species found that different fungal exudates differed in their effect on excised roots of *Pinus sylvestris*. Exudates of *Amanita muscaria* stimulated elongation of excised radicles and induced lateral root formation; *Suillus* (*Boletus*) *variegatus* caused prolific induction of root initials. Slankis (1951) and Palmer (1954) reported that exogenous auxin stimulated elongation of pine roots at low concentration, inhibited it at higher concentration, and at still higher concentration induced new laterals in increasing numbers.

The fleshy bracken rhizome traversed by a network of vascular strands (meristeles) and bands of sclerenchyma holds a rich store of nucleotide sugars, carbohydrates, and a number of other compounds which provide a good energy source for invading mycorrhizal fungi. The fibrous rhizome 'casing' facilitates accumulation of exudates (hormones and growth regulators) of host as well as of fungus and probably favours early effective symbiosis. Since the concentration of hormonal substances remains low in the early stages of infection, it is likely that stimulation of both long and short roots from the lateral is possible. As the concentration builds up within the confines of the rhizome, further development of long roots is inhibited and the frequency of short roots increases. As the 'casing' proves an effective barrier against loss of exudates, structures closely resembling coralloid mycorrhizae develop in large numbers at levels of increased concentration.

The fungal component of the mycorrhiza-like structures was not identified. However, circumstantial as the evidence may be, the possibility of a true symbiosis is strong. The premise for this is the occurrence of fruiting bodies of mycorrhizal fungi like *Amanita muscaria*, *Suillus* spp, *Rhizopogon* spp, *Thelephora terrestris*, *Russula* spp, etc. which are strictly confined to pine plantations and not found in the adjacent wattle and *Eucalyptus* plantations in this locality.

Obviously this is an oversimplified account of the occurrence of

mycorrhiza-like structures and the synergistic and antagonistic influences of the partners in causing the biochemical and biological transformations. The phenomenon is probably the result of a multitude of factors which take place within the confines of the decayed rhizome.

As the rhizome appears to be a rich source of nutrients and other compounds, and a good medium for fungal growth and development it may be possible to use it as a growth promoter in the nursery, either in mother bed or in polycontainers.

References

Duncan, H. J. and Jarvis, M. C. (1976). Nucleotides and related compounds in bracken. Taxonomy and phytogeography of bracken—a review. *J. Linn. Soc. (Botany)* 1–34.

Palmer, J. G. (1954). Mycorrhizal development in *Pinus virginiana* as influenced by growth regulators. Ph.D. Thesis, George Washington University, Washington, DC.

— and Hacskaylo, E. (1970). Ectomycorrhizal fungi in pure culture. I. Growth on single carbon sources. *Physiologia Pl.* 23, 1187–97.

Slankis, V. (1951). Über den Einfluss von B-Indolylessigsäure und anderen Wuchsstoffen auf das Wachstum von Kiefernwurzeln. I. *Symb. bot. upsal.* 11, 1.

— (1958). The role of auxin and other exudates in mycorrhizal symbiosis of forest trees. In *Physiology of forest trees* (ed. K. V. Thimann) pp. 427–43. Ronald Press, New York.

Turner, P. D. (1962). Morphological influences of exudates of mycorrhizal and nonmycorrhizal fungi on excised root cultures of *Pinus sylvestris* L. *Nature, Lond.* 194, 551.